Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

**Quantitative determination of the enhanced magnetoelectric** YOON SEOK OH, KEE HOON KIM, Dept. of Physics and Astronomy, Seoul National University, STEVEN P. CRANE, R. RAMESH, University of California, Berkeley, SEONGSU LEE, S-W. CHEONG, Rutgers University — With growing interest worldwide toward applications of multiferroic materials for novel memory and magnetic sensor devices, there have been numerous efforts to synthesize multiferroic thin films with large magnetoelectric coupling. Yet, quantitative information on the magnetoelectric susceptibility (MES) of the film is still lacking because it is difficult to measure a reduced magnetoelectric signal due to a tiny thickness. In the present work, we have determined quantitative MES for a 300 nm $BiFeO_3$-$CoFe_2O_4$ nanostructure, 250 nm $BiFeO_3$ film, and $BiFeO_3$ single crystal with our highly sensitive magnetoelectric susceptometer operating in cryogenic (down to 2 K) and high magnetic field, $H$, (up to 9 T) environments. We find that the MES of the $BiFeO_3$-$CoFe_2O_4$ nanostructure shows a typical anti-symmetric shape with DC magnetic field up to 340 K, as expected in the magnetoelectric coupling mediated by strain between piezoelectric and magnetostrictive materials. At room temperature, the transverse MES of the nanostructure shows a maximum of 2 $\times 10^{-10}$ s/m at low $H$ = 6 kOe. Our results also demonstrate that the MES value of the nanopillar structured film is enhanced by approximately one order of magnitude than that of pure 250 nm $BiFeO_3$ film and $BiFeO_3$ single crystal.

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Date submitted: 02 Dec 2008 Electronic form version 1.4